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GERMINATION OF *Asphodelus tenuifolius* BIOTYPES AS INFLUENCED BY TEMPERATURE, DORMANCY BREAKING CHEMICALS AND THEIR CONCENTRATIONS

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ABSTRACT

Dormancy is the failure of seeds to germinate under favorable environmental conditions It is an adaptive significance in weeds to persist in the agro-ecosystems. Several chemicals inducing germination in seeds have been identified. Hence, laboratory studies on wild onion (Asphodelus tenuifolius) seeds were undertaken at weed science department NWFP, Agricultural University Peshawar, Pakistan to investigate the dormancy breaking by using GA_3, KNO_3, Thiourea and Sodium Azide at 0 to 800 ppm exposed to 10, 20 and 30°C temperature regimes. Experiment was laid out in completely randomized design with a split-split-split plot arrangement Temperatures were assigned to main plots, biotypes to sub-plots, while chemicals to sub-sub plots and the concentrations were assigned to sub-sub-sub plots. Each sub-sub-sub-plot comprised of single Petri-dish planted with 20 seeds of Asphodelus tenuifolius. The germination percentage data were subjected to ANOVA and the means were separated by LSD test. The data revealed temperatures, biotypes, chemicals, concentrations and their interactions significantly affecting germination except the interactions temperature x biotypes x concentration, biotypes x chemical x concentrations. The highest germination was recorded at 20°C (47.41%), while on 1.09% germination was recorded at 30°C. Mianwali biotypes germinated the most (40 83%) as compared to 24.38 and 22.88% germination in Karak and Bhakkar biotypes. Miawali biotype when exposed to 20°C had the highest germination (69.13%). Among the chemicals the highest germination was recorded in KNO_3 and thiourea. Mianwali biotype when exposed to KNO_3, GA_3 or thiourea out performed all other biotype x chemical interactions The temperature effect over-rided the chemicals or biotype effects.

Key words: Wild onion, biotypes, temperature, chemicals, concentrations

INTRODUCTION

Wild onion *(Asphodelus tenuifolius* Cav.) is a notorious weed of sand soils of Indo-Pak sub-continent. It belongs to family Ashodelaceae. It is annual in habit. It has been observed as a serious weed of rabi crops including chickpea *(Cicer arietinum* L.), wheat *(Triticum aestivum* L.) and rapeseed and mustard *(Brassica* spp.) in sandy Districts of NWFP viz Karak, Lakki Marwat and parts of Dera Ismail Khan. In the Punjab, it is worst competitor with rabi crops in Mianwali, Bhakkar, Jhang and Layyah. Farm surveys conducted during 2003 by our group list *Asphodelus tenuifolius* as the top most weed of chickpea in Lakki Marwat and Karak (Hassan and Khan, 2005) In Dera Ismail Khan and Lakki Marwat it has been observed by our group that the

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infestation of chickpea is more in chickpea as compared to wheat. It was postulated that as wheat is planted later, by that time some of the weed had geminated which is uprooted at the time of planting. While due to thermo-sensitivity of seed during the earlier planting of chickpea seeds do not germinate due to higher temperatures prevailing at that time. Thus, in order to substantiate the hypothesis under laboratory conditions, the instant studies were undertaken to formulate the planting time of chickpea in light of our findings. Sahi and Bhan (1991) from India also reported the rapid germination of *Asphodelus* at 20°C. The range of temperature was reported as 10 to 35°C. However, the highest germination was at 15°C.

In Pakistan, during 2004-05, chickpea was grown on an area of 1093.9 thousands ha with a production of 868.3 thousand tons. During the same year, the area production in NWFP was 52.4 thousand ha and 34.3 thousand tons, respectively. Punjab with an area of 956.4 thousand ha is the leader in chickpea production in Pakistan (MINFAL, 2005).

There are several features, which have rendered the weed species successful, but most important one is the seed dormancy or rest period, which enables the seeds to persist in the soil and survive under the conditions not suitable for plant growth (Karssen, 1982; Harper, 1977; Holt, 1987). Numerous investigations spread over many years have studied basic and practical aspects of the problem (Crocker and Barton, 1953). Benvenuti and Macchia (1995) showed that the high CO_2 and low O_2 (hypoxia) induced dormancy. Several studies exhibit that the buried seeds of annual weeds undergo dormancy-non-dormancy cycles and even light does not stimulate germination (Schafer and Chilcote, 1970; Taylorson, 1970). Recently Hassan, et al. (2004) and Hassan and Khan (2005) observed a differential response of temperatures and dormancy breaking chemicals on wild oats and curly dock.

Keeping in view the aggressiveness of this species in NWFP and other provinces as weed of chickpea, a research project was undertaken under laboratory conditions with the following objectives:.

1. To provide detailed information about dormancy occurrence in different biotypes of *A. tenuifolius*.
2. To figure out the behavior of dormancy related to different dormancy breaking chemicals, their concentrations and temperature regimes.

MATERIALS AND METHODS

The seeds of *A. tenuifolius* collected from different locations in Pakistan viz Bannu, Karak, Bhakkar and Mianwali Districts of Pakistan, during April, 2005 from chickpea based cropping areas. Experiment was laid out in completely randomized design with a split-split-split plot arrangement. Temperatures were assigned to main-plots, while biotypes to sub-plots, chemicals to sub-sub-plots and concentrations to sub-sub-sub plots. The experiment was replicated twice, each sub-plot comprised of a single petri dish planted with 20 seeds. The experiment was undertaken under the controlled environment by subjecting the seeds to different temperature regimes, GA_3, KNO_3, Thiourea and Sodium Azide. Laboratory studies were initiated in Weed Science Department, NWFP Agricultural University Peshawar, Pakistan during 2005 to investigate the response of wild onion (*Asphodelus tenuifoilius*) seeds to GA_3, KNO_3, Thiourea and Sodium Azide at 0 to 800 ppm exposed separately to 10, 20 or 30°C temperatures. The experiment under laboratory conditions was undertaken from28th Many 2005 to 24th

August, 2005. The seeds were incubated in the seed germinator (Growth Chamber Model No.2020-2E, Shelab Manufacturing Inc., 300 N, and 26th Cornelius, OR 97113) for 4 weeks and the data were recorded on the germination. The germinated seeds were subsequently converted to percentage germination. The germination percentage data were subjected to ANOVA and the means were separated by LSD test (Steel and Torrie, 1980).

RESULTS AND DISSCUSSION

Analysis of variance of the data revealed that temperature and biotypes interaction had significant effect on the germination. The data in Figure-1 exhibit that the highest germination (47.41%) was recorded at 20°C. Almost no germination (1.09%) occurred at 30°C. Among the biotypes, Minawali (40.83%) scored the highest germination, while the lowest germination (22.88%) was recorded in Bhakkar biotype which was also statistically at par with Karak biotype (24.38%). For the temperature x biotype interaction, the highest germination (69.13%) subjected to 20°C. As low as 0.75 to 1.5% was recording in all the biotypes involving 30°C. The behavior of biotypes was differential when exposed to 20°C.

The chemical KNO_3 induced the maximum germination (40.96%), however it was statistically comparable with Thiourea, which in turn was statistically similar with GA_3 (35.5%). Sodium azide inhibited germination *A. tenuifolius* by having 7.42% germination (Figure-2). For the temperature x chemical interaction the maximum germination (62.25%) was deciphered at 20°C treated with KNO_3, however it was statistically at par with GA_3 and Thiourea subjected to 20°C and KNO_3 at 10°C. Minimum germination in same interaction was recorded in all the chemicals involving 30°C (Figure-2).

The temperature x concentration interaction exhibited the highest germination (58.28%, 53.28%) at 0ppm under 20°C and 10°C, respectively. The minimum germination ranging between 0.63 to 1.56% was observed under 0-800 ppm subjected to 30°C(Figure-3).

The biotype x chemical interaction revealed the highest germination (54.0%) in Mianwali treated with KNO_3. It was however, statistically at par with the same biotype treated either with GA_3 (52.67%) or Thiourea (46.50%). Sodium azide treated all biotypes possessed the lowest statistical germination (Figure-4).

The chemical x rate interaction significant statistically enunciated the maximum germination (44.79%) in KNO_3 at 600ppm. It was statistically at par with several interactions involving thiourea and GA_3 (Figure-5). The lowest germination was manifested under the inhibitory behavior of sodium azide.

These findings are in a great analogy with the previous work of Sahi and Bhan (1991), Mishra *et al* 2002. Mishra *et al* 2001, Poonia et al 2001, Hassan *et al.* (2004) and Hassan and Khan (2005) Yadev an Poonia (2005), Yaduraju (2000) who concluded the temperature as the most important parameter affecting germination. Bennvenuti and Macchia (1994), Karssen, 1982, Harper, 1977 and Holt, 1987 also support the instant findings.

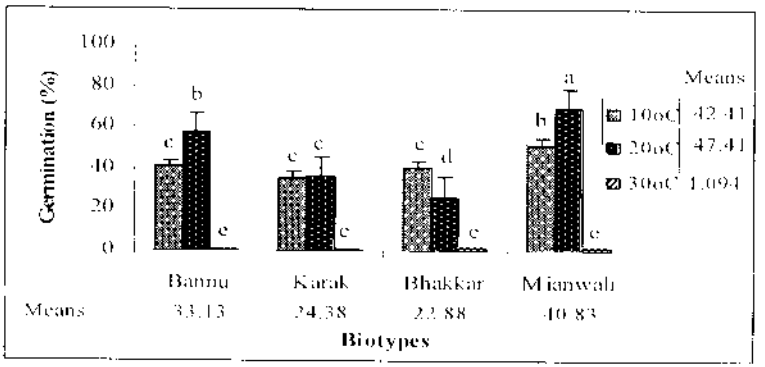

Figure-1. **Temperature x biotypes interaction for seed germination pattern in *Asphodelus tenuifolius***

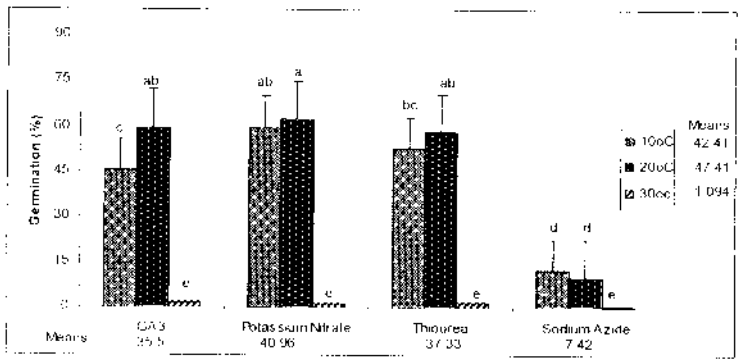

Figure-2. **Temperature x chemicals interaction for seed germination pattern in *Asphodelus tenuifolius***

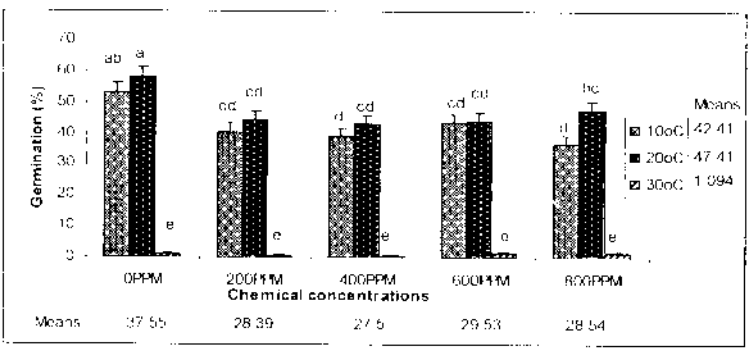

Figure-3. **Temperature x chemicals concentrations interaction for seed germination pattern in *Asphodelus tenuifolius***

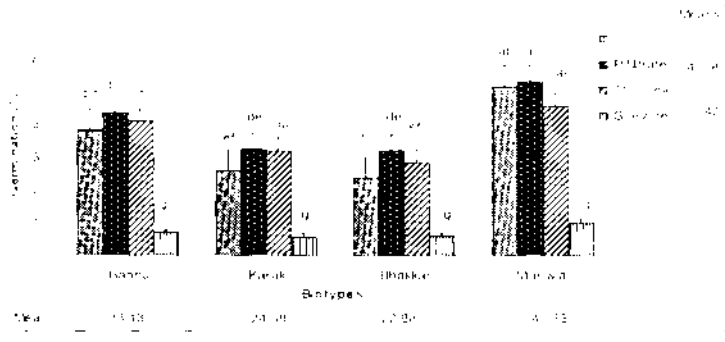

Figure-4. Chemicals x biotypes interaction for seed germination pattern in *Asphodelus tenuifolius*

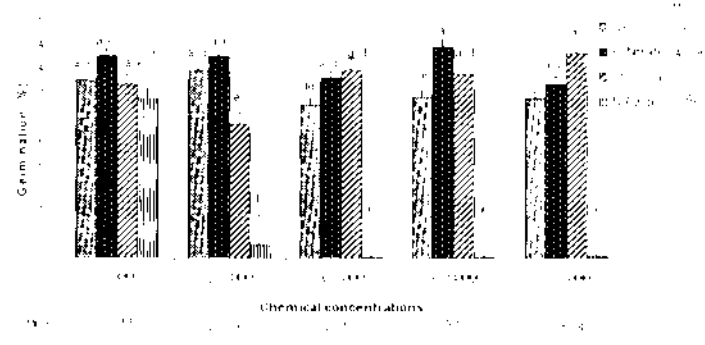

Figure-5. Effect Chemicals and their concentrations interaction for seed germination pattern in *Asphodelus tenuifolius*

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